

ELECTRONIC FUNDAMENTALS

EXPERIMENT LESSON 25

BIAS EXPERIMENTS



RCA INSTITUTES, INC.

A SERVICE OF RADIO CORPORATION OF AMERICA

HOME STUDY SCHOOL

350 West 4th Street, New York 14, N. Y.

KIT 13

BILL OF MATERIALS

Quantity	Item
1	6BA6 electron tube
6"	Hookup wire, shielded
2	Knob, round, 1" diameter
1	Knob, round, 2-5/16" diameter
1	Resistor, 22 k-ohms, 1/2 watt
2	Resistor, 180 ohms, 1/2 watt
1	Resistor, 4,700 ohms, 1/2 watt
1	Resistor, 10 k-ohms, 2 watts
2	Capacitor, 270 $\mu\mu\text{f}$, mica
1	Capacitor, 470 $\mu\mu\text{f}$, mica
2	Capacitor, 0.01 μf , tubular

If you get a part slightly different from a part described in this list, the substitute part will not interfere electrically or mechanically with your experiments or equipment.

All the parts in Kit 13 are listed above. Check the parts you receive against this list. Make sure you have the correct quantity of every item. If a part is either missing or defective upon arrival, request a replacement from Department R, Home Study School, RCA Institutes, Inc., 350 West 4th Street, New York 14, N.Y. *Your request must include your name and student number, the complete name and description of the part copied from the Item column above, the Quantity missing or defective, and the reason you are asking for a new part.*

Experiment Lesson 25

INTRODUCTION

In your studies of electron tubes and amplifier circuits, you have seen that a certain amount of steady d-c voltage, called *bias voltage*, must be applied to the control grid of the electron tube. This bias voltage is used to establish the operating point of the tube, which is usually near the middle of the straight portion of its characteristic curve. In previous experiments, you have used a flashlight cell as a source of bias voltage. The voltage from dry cells drops off with age. Therefore, they are not usually used to supply bias voltage. Although special grid-bias cells are sometimes used, bias for electron tubes is almost always obtained by one of the methods shown in this lesson.

EQUIPMENT NEEDED

Multimeter
Signal generator
Radio-receiver chassis
Resistor board
Capacitor board
One 5 k-ohm 10-watt resistor
One 10 k-ohm 5-watt resistor
One 3.3-megohm resistor
One 10-megohm resistor
Four 1.5-volt dry cells
Two 2-lug Terminal Strips
Clip lead

JOB 25-1

To prepare the radio-receiver chassis for the next experiment.

Procedure.

Step 1. Examine your chassis and compare it with Fig. 25-1, which shows how your chassis should appear at the end of Experiment 24. If you have made any changes in your wiring, correct your chassis so that it agrees with this figure.

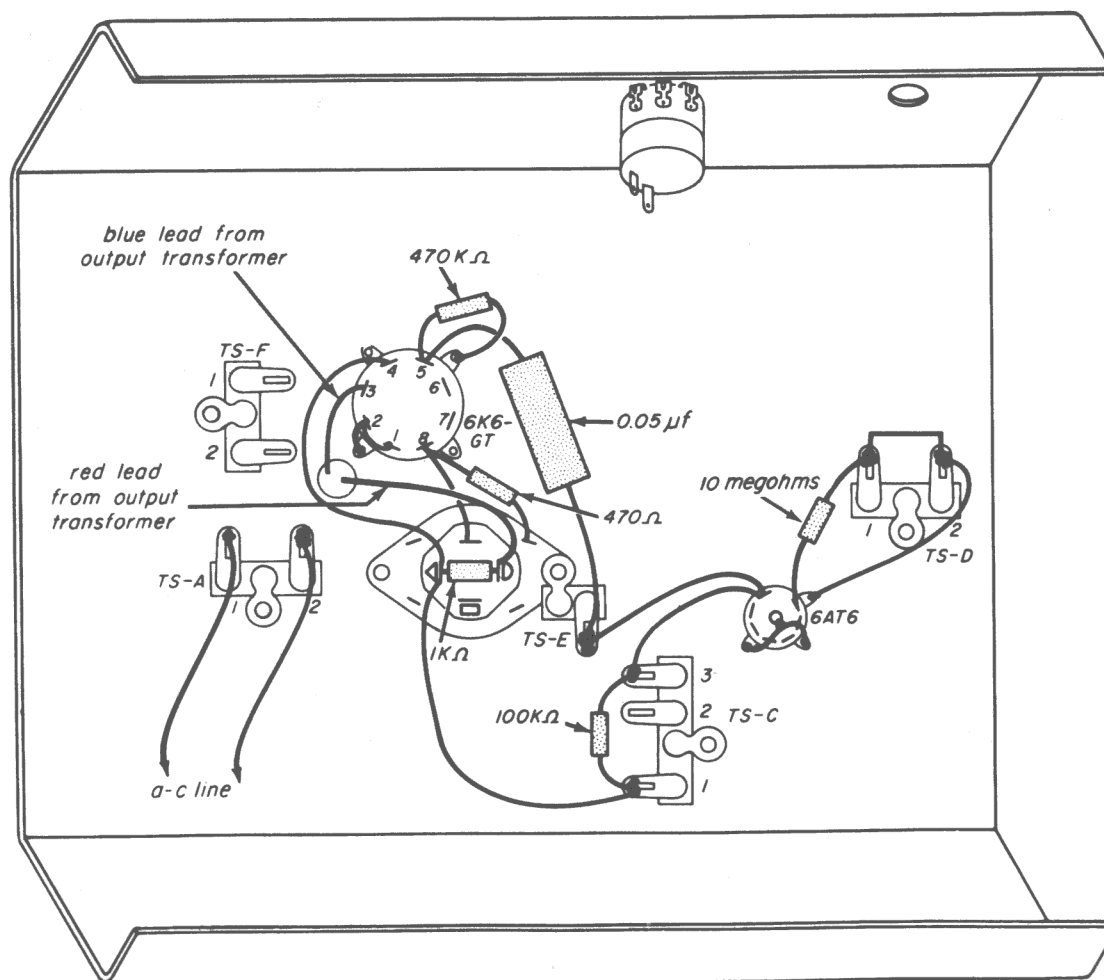
Note: All solder connections made in this experiment are temporary solder connections unless otherwise noted.

Step 2. Disconnect the lead of the 100 k-ohm resistor (in the plate circuit of the 6AT6) that goes to lug 1 of TS-C, and connect this lead to lug 2 of this terminal strip, as shown in Fig. 25-2. (This is to allow the meter to be inserted in the 6AT6 plate circuit.)

Step 3. Mount two 2-lug terminal strips as shown in Fig. 25-2. Solder a 5 k-ohm 10-watt resistor to one of the terminal strips and solder a 10 k-ohm 5-watt resistor to the other terminal strip. Connect one end of the 5 k-ohm resistor to one end of the 10 k-ohm resistor, as shown in the figure. Connect a lead from the free end of the 5 k-ohm resistor to the $\bigcap$ (semicircle) section of the electrolytic capacitor. Connect a lead from the free end of the 10 k-ohm resistor to a ground lug on the electrolytic capacitor. The purpose of these resistors is to act as a temporary load on the power supply.

Step 4. At the Δ (triangle) section of the electrolytic capacitor, disconnect the wire from lug 1 of TS-C, and connect it to the $\bigcap$ (semicircle) section of the electrolytic capacitor, as shown in the figure.

Step 5. Connect the negative terminal of a 1.5-volt cell to pin 1 of the 6AT6 socket, and the positive terminal to lug 2 of TS-D.



Note: Your batteries should still be in good condition. However, it is a good idea to check them, and replace any whose voltage has fallen below 1.5 volts.

Step 6. Compare your chassis with the pictorial diagram of Fig. 25-2, and the schematic diagram of Fig. 25-3. If your wiring is correct, proceed with the experiment.

EXPERIMENT 25-1

To study the method of obtaining bias by means of a cathode resistor.

Procedure.

Step 1. Remove the 6K6-GT tube from its socket.

Step 2. Connect the a-c line cord to an a-c outlet, and allow the tubes to warm up.

Step 3. Set up your multimeter on the 10MA DC scale. Hold the positive meter lead to lug 1 of TS-C, and the negative meter test lead to lug 2 of this terminal strip. Measure the plate current of the 6AT6 and record it here:

1.5

ma d.c.

Step 4. Remove the meter and disconnect the line cord.

Step 5. Connect your clip lead across pins 1 and 2 of TS-C.

Step 6. Set up the meter to the 5-volt DC range.

Step 7. Plug the a-c line cord into an a-c outlet.

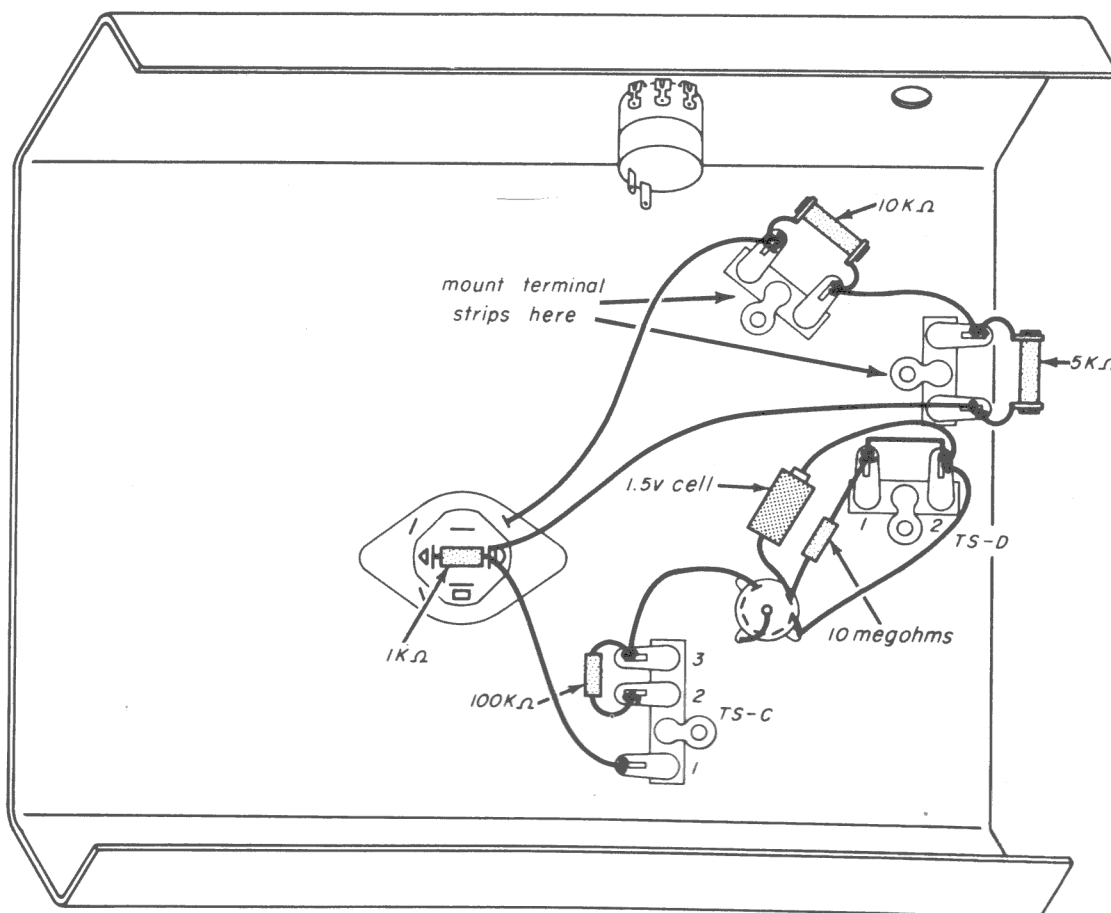


Fig. 25-2

Step 8. Measure the voltage between grid and cathode of the 6AT6 tube and record it here:

1.5

volts d.c.

Step 9. Disconnect the line cord, remove the 1.5-volt cell from the circuit, and connect a short piece of wire in place of the battery (from pin 1 of the 6AT6 tube socket to lug 2 of TS-D).

Step 10. Connect in series the 1,000-ohm and the 100-ohm resistor on the resistor breadboard.

Step 11. Remove the wire connecting the cathode of the 6AT6 to ground, and insert the 1,100-ohm resistor prepared in Step 10 between cathode and ground, as shown in Fig. 25-4.

Step 12. Plug the line cord into an a-c outlet, and allow the tubes to warm up.

Step 13. With the meter set to the 5 VDC range, measure the voltage from cathode (pin 2) to ground, and record it here:

1. D

volts d.c.

Note the polarity of the voltage at the cathode with respect to ground and record it here:

pos +
cathode polarity

Where does this voltage come from?

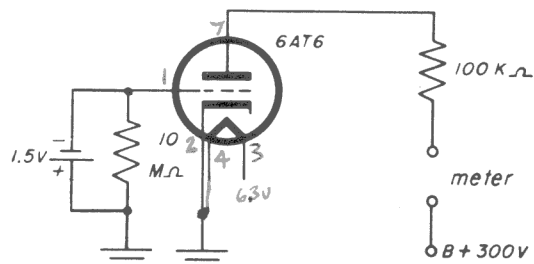


Fig. 25-3

Step 14. With the meter still set to the 5 VDC range, measure the voltage between grid and cathode of the 6AT6 tube, and record it here:

1.5
volts d.c.

Note the polarity of the voltage at the grid with respect to cathode and record it here:

neg. —
grid polarity

Where does this voltage come from?

Step 15. Disconnect the line cord, and remove the clip lead across lugs 1 and 2 of TS-C.

Step 16. Plug the line cord into an a-c outlet and allow the tubes to warm up.

Step 17. Set up the multimeter to the 10 MA DC range, and connect it in series with the plate circuit, as in Step 1. Measure the plate current and record your reading here:

1.4
ma d.c.

How does this current compare with the current measured in Step 3. Why?

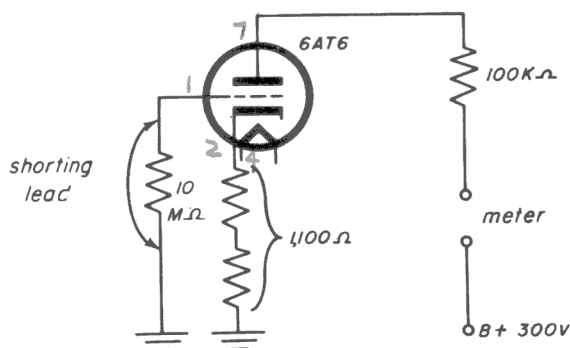


Fig. 25-4

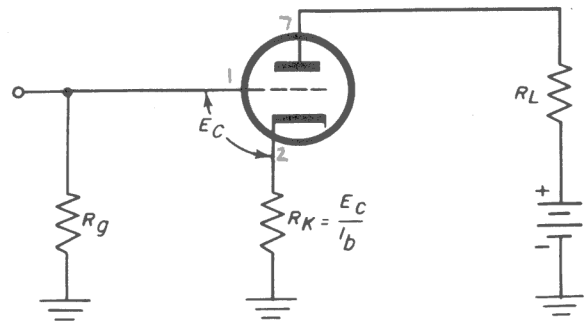


Fig. 25-5

How does the voltage measured in Steps 13 and 14 compare with the voltage measured in Step 8. Why?

Step 18. Disconnect the line cord.

Step 19. Using the value of current measured in Step 17, calculate the voltage drop across the 1,100-ohm resistor by Ohm's Law.

$$E = I \times R = .0014 \times 1100$$

Record your result here:

1.54
volts d.c.

How does this compare with the voltage measured in Steps 13 and 14.

Discussion. This experiment illustrates a very important and widely used type of bias known as cathode bias. To produce this type of bias, a resistor R_k is inserted in the cathode circuit of the tube, as shown in Fig. 25-5. In order to determine the size of the resistor required, the total current flowing in the cathode circuit must be known. (In the case of the triode, cathode current equals plate current. In the case of a pentode, cathode current equals the sum of the plate and screen currents.) With the cathode current known, the size of the resistor is determined by Ohm's Law:

$$R = \frac{E_c}{I_k}$$

where:

E_c is the required bias voltage

I_k is the cathode current

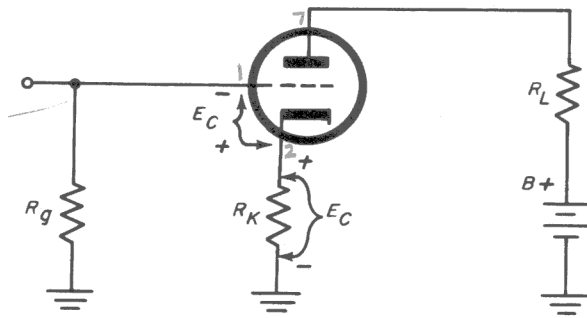


Fig. 25-6

The voltage produced across the cathode resistor is positive with respect to ground, as shown in Fig. 25-6. However, because the grid is connected through R_g to the negative end of R_k , as in the figure, the voltage across R_k makes the grid negative with respect to cathode, as is required for bias. Since no current flows through the grid resistor, R_g , it has no effect on the bias voltage.

In our laboratory, about 1.4 ma was measured in the plate circuit with 1.5 volts bias applied to the tube from a flashlight cell. To find the size of resistor that would produce this same amount of cathode bias, Ohm's Law is applied as described above.

$$R = \frac{1.5 \text{ v}}{0.0014 \text{ a}} = 1,100 \text{ ohms (approx)}$$

When this amount of resistance, consisting of 1,000-ohm and a 100-ohm resistor in series, is inserted in the cathode circuit, practically the same bias and plate current are obtained.

EXPERIMENT 25-2

To study the disadvantage of cathode bias, which is the reduction of output due to degeneration caused by the cathode resistor, and how it may be overcome.

Procedure.

Step 1. Remove the short from pin 1 (grid) of the 6AT6 tube socket to lug 2 of TS-D. Remove the short across lugs 1 and

2 of TS-D, and replace it with the 1.5-volt flashlight cell. The negative terminal of the cell is connected to lug 1.

Step 2. Disconnect the 1,100-ohm resistor combination from the cathode of the tube, and connect the cathode to ground.

Step 3. Connect the clip lead across lugs 1 and 2 of TS-C.

Step 4. Plug in your signal generator and allow it to warm up. See that the bandswitch is turned to Band X, and the cable is connected to the AF OUTPUT jack. Connect the cable to the grid (Pin 1) of the 6AT6 and ground.

Step 5. Set up the multimeter to the 75 VAC range, and insert the positive meter lead into the OUTPUT jack. Connect the meter to the plate (pin 7) of the 6AT6 tube socket and to ground.

Step 6. Plug the receiver line cord into an a-c outlet and allow the tubes to warm up.

Step 7. Adjust the AF OUT/INT MOD control on the signal generator to produce 45 volts a.c. at the plate of the 6AT6 tube. *Do not disturb this setting.*

Step 8. Disconnect the receiver line cord from the a-c outlet, and disconnect the battery. Replace the short across lugs 1 & 2 of TS-D.

Step 9. Insert the 1,100-ohm resistor combination on the resistor breadboard between cathode (pin 2) and ground.

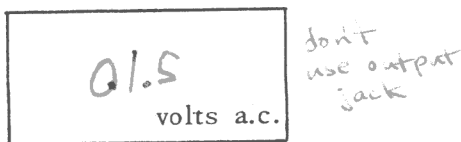
Step 10. Plug the receiver line cord into an a-c outlet, and allow the tubes to warm up.

Step 11. Note the a-c output at the plate as shown by the output meter and record it here:

27
volts a.c.

How does this compare with the output measured in Step 7? Why?

Step 12. Turn the range switch to the 15 VAC position. Note the voltage at the cathode (pin 2) of the 6AT6 tube. Record it here:

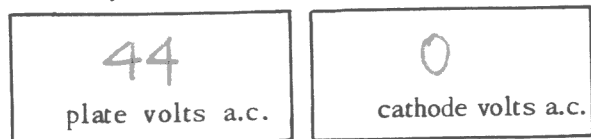


Step 13. Unplug the receiver line cord.

Step 14. Disconnect at the 25- μ f terminal of the electrolytic capacitor the short piece of wire to pin 8 of the 6K6-GT tube socket.

Step 15. Connect a piece of wire between the cathode (pin 2) of the 6AT6 tube and the 25- μ f section of the electrolytic capacitor.

Step 16. Repeat Steps 10, 11, and 12. Record your readings here:



How does the output voltage compare with the voltage measured in Step 7?

Step 17. Unplug the line cord. Remove the 1,100-ohm resistor combination, and ground the cathode (pin 2). Remove the wire from the cathode to the electrolytic capacitor. Reconnect the wire from pin 8 of the 6K6-GT socket to the electrolytic capacitor. Remove the signal-generator cable.

Discussion. This experiment shows that a resistor in the cathode circuit reduces the amplifier output, unless the resistor is bypassed. The reason for this degeneration or negative feedback has already been demonstrated and explained in the Theory Lesson and the Experiment Lesson on voltage amplifiers. Degeneration is due to the signal voltage that is developed across the cathode resistor because of the a-c signal current flowing through it, as shown in Fig. 25-7a. The voltage at the cathode at any instant is in phase with the voltage at the grid at that instant. However, this makes the two voltages series opposing as far as the total voltage between grid and cathode is con-

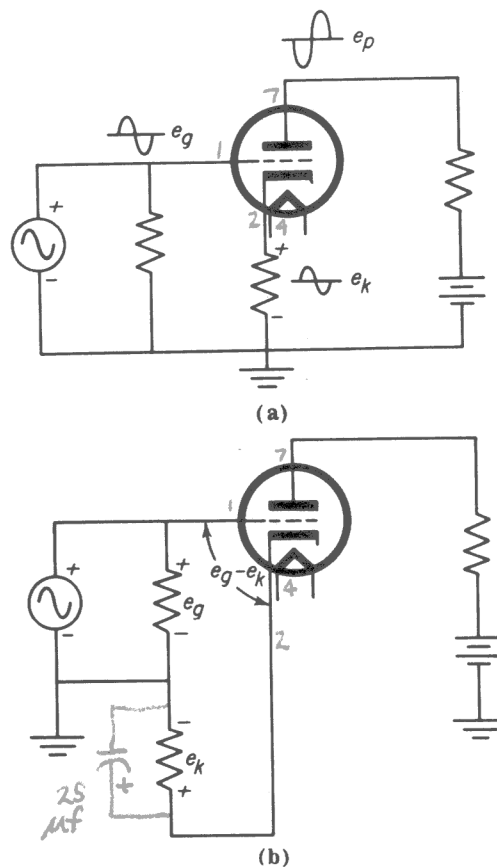


Fig. 25-7

cerned, as shown in Fig. 25-7b. By putting a bypass capacitor across the cathode resistor, the d-c voltage across it may still be obtained, but the a-c signal, which causes degeneration, is shorted out. In order for the a-c signal across the cathode resistor to be effectively shorted out, the reactance of the bypass capacitor must be low compared with the cathode resistance at the lowest audio frequencies at which the amplifier is expected to operate. Usually the capacitor is made large enough so that its reactance is one-tenth of the cathode resistance at the lowest frequency at which good output is desired. So bypass capacitors for audio amplifiers should be quite large; about 25 μ f. Therefore, audio bypass capacitors are usually electrolytic.

Typical results for this experiment are as follows. When the 1,100-ohm resistor is put into the cathode circuit to provide bias of 1.5 volts in place of the 1.5-volt cell, the output falls from 45 volts a.c. to about 27 volts a.c. When the resistor is bypassed with the 25- μ f electrolytic capacitor, the output

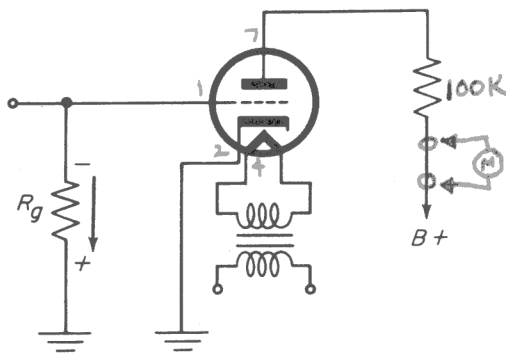


Fig. 25-8

voltage returns to the original 45 volts. This is because the reactance of the 25- μ f electrolytic capacitor is low enough to completely short out any a-c signal voltage appearing across the cathode resistor.

EXPERIMENT 25-3

To study the biasing of high- μ tubes by means of large-value grid resistors.

Information. When the cathode of a vacuum tube is heated, and the control grid is returned to the cathode by means of a resistor, as shown in Fig. 25-8, current will flow through the resistor even though no other voltages are applied to the tube. If the resistor is large enough, a voltage can be measured at the grid due to the current flow through the resistor. This voltage is negative at the grid, indicating that current is flowing down through the resistor as shown in the diagram. Since this voltage makes the grid negative, it may be used to provide bias for the tube. The amount of bias voltage obtained in this way is sufficient to properly bias high- μ tubes, where the input signals are small. The 6AT6 audio amplifier in your receiver uses this type of bias.

In this experiment, you will study this type of bias, which is sometimes called *contact bias*, and find out how the amount of bias voltage obtained is related to the size of the grid resistor. This voltage cannot be accurately measured with your meter, since it will load down the grid circuit even though the meter resistance is as high as 20,000 ohms per volts. The bias voltage is determined indirectly by measuring the plate

current. The bias voltage is then found by using the 6AT6 characteristics, which are given in Fig. 25-9. The load line for a 100 k-ohm plate load and 300 volt B+ voltage has been drawn on the chart. Mark the point along the load line corresponding to the current measured. From the position of this point with respect to the characteristic curves, estimate the bias on the tube. For example, suppose that 1.9 ma is measured. The point on the load line corresponding to 1.9 ma is shown at X on the figure. This point is located almost halfway between the $E_c = 0_v$ line and the $E_c = 1$ volt line, and therefore the bias corresponding to 1.9 ma must be 0.5 volts.

Procedure.

Step 1. Remove the 10-megohm resistor between the grid (pin 1) of the 6AT6 and lug 1 of TS-D. Replace it with a 10 k-ohm resistor.

Step 2. Remove the clip lead across lugs 1 and 2 of TS-C.

Step 3. Set up the meter to the 10 MA DC range.

Step 4. Plug the receiver line cord into an a-c outlet, and allow the tubes to warm up.

Step 5. Touch the positive meter lead to lug 1 and the negative lead to lug 2 of TS-C. Measure the current flowing in the plate circuit and record it in the first line of Table A. Read the meter as accurately as you can.

Step 6. Disconnect the line cord and replace the grid resistor with the next value called for in Table A.

TABLE A

Grid Resistance	Current	Bias Voltage
10 k-ohms	1.3	1.7
100 k-ohms	1.2	1.9
3.3 megohms	1.1	2.1
10 megohms	1.05	2.2

6AT6 AVERAGE PLATE CHARACTERISTICS TRIODE UNIT

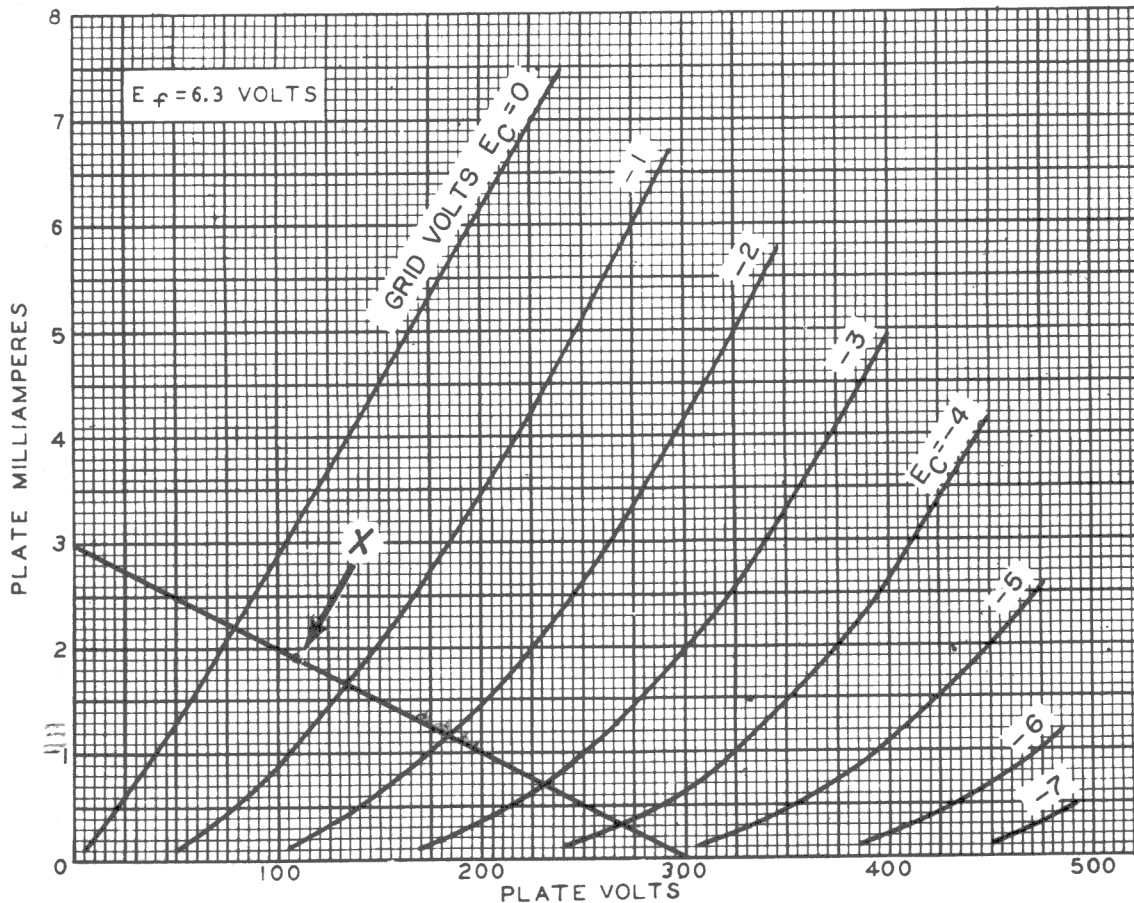


Fig. 25-9

Step 7. Plug the receiver line cord into an a-c outlet, and allow the tubes to warm up. Measure the current flowing and record it alongside the corresponding grid resistor in the table.

Step 8. Repeat Steps 6 and 7 until the first column of Table A is completely filled out.

Step 9. Disconnect the line cord and replace the 10-megohm grid resistor between pin 1 of the 6AT6 tube socket, and lug 1 of TS-D.

Step 10. Replace the clip lead across lugs 1 and 2 of TS-C.

Step 11. Using the tube characteristics given in Fig. 25-9, determine the bias for

each current value in the table, as explained previously, and fill out the last column of the table.

Step 12. On the graph paper provided at the end of this booklet, plot a curve of bias voltage versus grid resistance.

Discussion. Typical results for this experiment are given in Table B and Fig.

TABLE B

Grid Resistance	Current	Bias Voltage
10 k-ohms	2.0 ma	0.35 v
100 k-ohms	1.85 ma	0.6 v
3.3 megohms	1.7 ma	0.9 v
10 megohms	1.65 ma	1.0 v

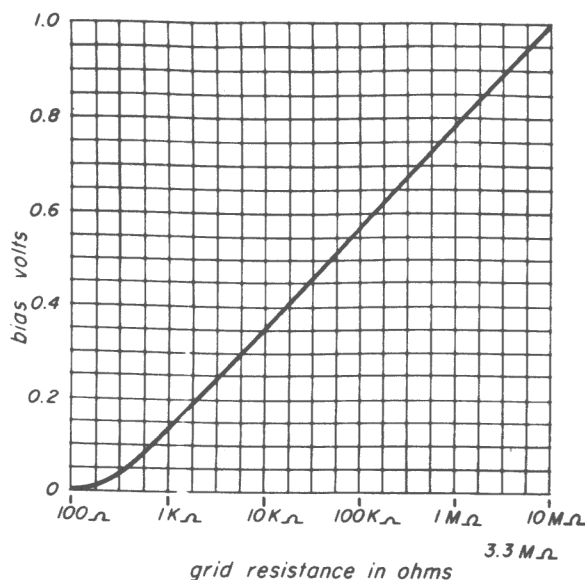


Fig. 25-10

25-10. This data shows that bias voltages up to about 1 volt may be obtained by putting a grid resistor of the appropriate size in the grid circuit. Since the amount of input signal is limited by the bias voltage, this type of bias is suitable only where the input signals are small. It is used with such tubes as the 6AT6, 6AV6, 6SQ7 and others that are designed to operate without distortion with small values of grid bias.

EXPERIMENT 25-4

To study grid-leak signal bias.

Information. In this experiment, you will study two circuit arrangements in which the incoming signal is made to develop d-c operating bias for the tube. Although this type of bias is usually not used in amplifiers, it is an important source of bias. It is used to obtain the bias for almost all types of oscillators, many television circuits, and for high-power r-f amplifiers in transmitting equipment. One of the important features of this type of bias is that it automatically adjusts itself according to the level of the incoming signal — the larger the incoming signal, the greater the bias, as we shall see in this experiment.

Procedure.

Step 1. Connect a wire between grid (pin 1) of the 6AT6 socket and the 0.25- μ f

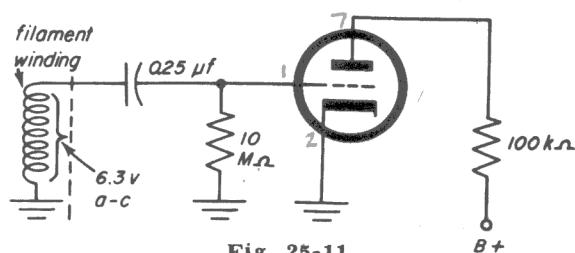


Fig. 25-11

capacitor on the capacitor breadboard. Connect the other end of the capacitor to pin 2 of the 6X5-GT tube socket, as shown in Fig. 25-11. Compare your chassis wiring with this figure, and proceed with the experiment when your connections are correct.

Step 2. Plug the receiver line cord into an a-c outlet and allow the tubes to warm up.

Step 3. Set up the meter to the 15 VAC range and measure the voltage from pin 2 of the 6X5 to ground. This is the signal voltage applied to the circuit. Record the reading here:

6.5
volts a.c.

6.5
1.414
260
260
65
9.1910

Step 4. Calculate the *peak* voltage value of the applied signal voltage. (Peak voltage = 1.414 x rms voltage). Enter your result here:

9.2
volts a.c. peak

Step 5. Set the meter up to the 100 VDC range, and measure the d-c voltage at the grid (pin 1) of the 6AT6 tube. Record your reading here:

9.9
volts d.c.

How does this voltage compare with the voltage of Step 4. Where does this d-c voltage come from?

Step 6. Measure the voltage across the 0.25- μ f capacitor. (Negative meter test lead to the grid side of the capacitor.) Record

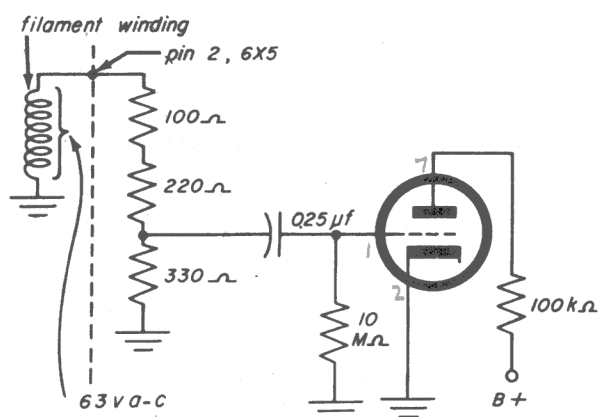


Fig. 25-12

your reading here:

10
volts d.c.

How does this voltage compare with the voltage of Step 5?

Step 7. Disconnect at pin 2 of the 6X5-GT socket, the lead to the 0.25- μ f capacitor.

Step 8. Connect the 100-, 220-, and 330-ohm resistors on the resistor series. Connect the free end of the 100-ohm resistor to pin 2 of the 6X5 socket, and the free end of the 330-ohm resistor to a ground point on the chassis.

Step 9. Connect the lead from the 0.25- μ f capacitor to the junction of the 220-ohm and 330-ohm resistors. Compare your chassis with the circuit shown in Fig. 25-12. When your connections are correct, proceed with the next step.

Step 10. Plug the line cord into an a-c outlet, and allow the tubes to heat up.

Step 11. With the meter set up on the 15 VAC range, measure the a-c voltage between the junction of the 220-ohm and 330-ohm resistors and chassis. This is now the input voltage for the circuit. Record your reading here:

3.2
volts a.c.

Step 12. Calculate the peak value of the voltage that you measured in Step 11. Enter your result here:

4.5
volts a.c. peak

3.2
1.414
4.5248

Step 13. Set up the meter to the 25 VDC range, and measure the voltage between grid (pin 1) of the 6AT6 tube and ground. Enter your reading here:

5
volts d.c.

How does this compare with the voltage of Step 12?

Step 14. Disconnect the line cord. Disconnect the lead from the junction of the 220-ohm and 330-ohm resistors and connect this lead to pin 2 of the 6X5 socket.

Step 15. Disconnect and remove the resistor board from the circuit.

Discussion. This experiment shows that applying a signal to a circuit such as that shown in Fig. 25-11 causes a d-c bias voltage to be developed across the grid-leak capacitor by the grid current, which flows during every positive half cycle of the signal voltage. This voltage appears in turn across the 10-megohm grid resistor (the drop across the 330-ohm resistor is so very slight that we may ignore it). The polarity of the charge is such that the grid is at a negative potential with respect to the cathode. If the time constant of the resistor-capacitor combination is made large enough so that the capacitor discharges very little between positive peaks of the input signal, the amount of bias developed will be very nearly equal to the peak value of the input signal. In this experiment, the time constant in the grid circuit is very large, and the d-c bias

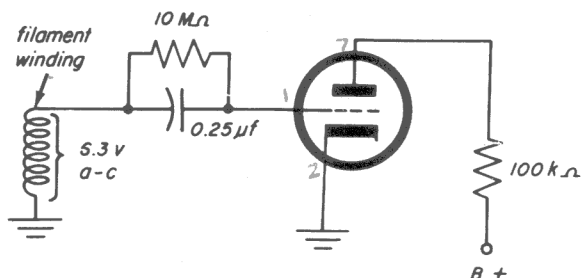


Fig. 25-13

is nearly equal to the peak of the 6.3-volt a-c signal applied, or about 9.2 volts.

The experiment also shows that the bias automatically adjusts itself according to the input signal. When the a-c input signal was cut in half, the d-c bias was also reduced to one half its former value. The peak value of 3.15 volts is about 4.4 volts, and the d-c bias is nearly equal to this value. This is because when the signal is increased or decreased, the capacitor charges up to the higher peak value, or down to the lower peak value, as the case may be.

EXPERIMENT 25-5

To study an alternate signal-bias circuit arrangement.

Procedure.

Step 1. Disconnect the 10-megohm resistor from pin 1 of the 6AT6 tube socket and lug 1 of TS-D. Connect the 10-megohm grid resistor across the 0.25-μf capacitor on the capacitor breadboard. Your circuit should now be as shown in Fig. 25-13.

Step 2. Set up the meter to the 15 VAC range. Plug in the line cord, and measure the voltage from pin 2 of the 6X5 to ground. This is the signal voltage applied to the circuit. Record it here:

6.5
volts a.c.

Step 3. Calculate the *peak* voltage value of the applied signal voltage. (Peak voltage = $1.414 \times \text{rms voltage}$). Enter your result

here:

9.2
peak volts a.c.

Step 4. Set the meter up to the 100 VDC range, and measure the d-c voltage at the grid (pin 1) of the 6AT6 tube. Record your reading here:

10
volts d.c.

How does this bias voltage compare with the bias voltage obtained in the previous experiment?

Step 5. Disconnect the line cord, remove the 0.25-μf capacitor, and replace the 10-megohm grid resistor between pin 1 of the 6AT6 tube socket and lug 1 of TS-D.

Discussion. The d-c bias obtained with the circuit arrangement shown in Fig. 25-13 is the same as the d-c bias obtained with the circuit arrangement of Fig. 25-11 used in the previous experiment. There is very little difference between the two circuits.

EXPERIMENT 25-6

To study a method of obtaining fixed bias from the receiver power supply.

Procedure.

Step 1. Disconnect the center-tap (coded red/yellow) lead of the power transformer from the chassis, and connect it to pin 6 of the 6X5 socket.

Step 2. Connect in parallel the 100-ohm and 330-ohm resistors on the resistor breadboard. Calculate the resistance of this parallel combination. Record your result here:

77
ohms

$$R_t = \frac{R_1 \times R_2}{R_1 + R_2} = \frac{100 \times 330}{100 + 330} = \frac{33,000}{430}$$

$$\frac{100 \times 330}{100 + 330} = \frac{33,000}{430}$$

Verify your calculation by measuring the resistance of the parallel combination with your ohmmeter; enter the result here:

75
ohms

Step 3. Plug the receiver line cord into an a-c outlet, and allow the tubes to warm up.

Step 4. Set up your meter to the 100 MA DC range. Touch the positive meter lead to the chassis, and the negative meter lead to pin 6 of the 6X5 socket. This is the total current being drawn from the power supply. Record the current reading here:

22
ma d.c.

Step 5. Disconnect the line cord, and connect one terminal of the parallel resistor combination to pin 6 of the 6X5 socket, and the other terminal to any convenient ground point on the chassis.

Step 6. The current measured in Step 4 will now flow through this resistor. Calculate the voltage drop across it:

1.65
volts d.c.

$$E = IR$$

Step 7. Plug the power cord into an a-c outlet, and allow the tubes to warm up.

Step 8. Set up the meter to the 5 VDC range. Measure the voltage drop at pin 6 of the 6X5 tube socket.

Enter your reading here:

1.55
volts d.c.

How does this compare with your calculation?

close

Note the polarity of the voltage:

Pin 6
negative
polarity

Step 9. Disconnect the line cord, and connect a wire between pin 6 of the 6X5 socket and pin 1 of the 6AT6 tube socket.

Step 10. Remove the jumper across lugs 1 and 2 of TS-C. Set up the meter to the 10 MA DC range, and connect it in place of the jumper (negative lead to lug 2 and positive lead to lug 1 of TS-C).

Step 11. Plug the line cord into an a-c outlet, and measure the plate current flowing. Record your reading here:

1.65
ma d.c.

How does the current compare with the plate current measured in Experiment 25-1? close

Step 12. Disconnect the line cord, remove the meter, and replace the jumper across TS-C. Insert the 6K6 tube in its socket.

Step 13. Plug the line cord into an a-c outlet, and allow the tubes to warm up. What is heard in the loudspeaker?

Step 14. Disconnect the line cord. Disconnect the parallel-resistor combination from pin 6 of the 6X5 tube socket and ground, and put aside the resistor board. Also disconnect the lead from pin 6 of the 6X5 socket to pin 1 of the 6AT6 tube socket.

Step 15. Cut and dress the red/yellow lead and make a permanent connection to a ground lug on the 6X5 tube socket.

Discussion. Inserting a resistor in series with the center-tap lead of the power-supply transformer is one method of obtaining fixed bias from the power supply of the receiver. Current flows through this resistor in such a

direction as to make the voltage across the resistor negative with respect to ground. If the total power-supply current is known, the size of resistor required to obtain bias may be determined by Ohm's law. The voltage drop across this resistor reduces the amount of B+ output available, but this effect is usually negligible. The hum heard in the loudspeaker indicates that the current through the bias resistor is not pure direct current and needs to be filtered before it can be used for bias purposes.

JOB 25-2

To prepare the chassis for the next experiment lesson.

Procedure.

Step 1. Disconnect all leads used to connect the 5 k-ohm 10 watt resistor and the 10 k-ohm 5-watt resistor into the circuit.

Step 2. Remove both resistors, and the terminal boards used to mount them, from the chassis and put them aside.



15
0.022
150
150
1.650